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The Master Study in Telemedicine and E-health at the University of Tromsø, Norway, 2005-2018

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Abstract. In this paper we describe the Master Study in Telemedicine and E-health at the University of Tromsø, Norway. The study enrolled its first students in 2005 and was closed in 2018. We describe and discuss the background of the programme, its development and accomplishments and why it was closed. Hopefully, this narrative will be of use to other programmes focusing on e-health.

Keywords. Telemedicine, E-health, Master Programme, Norway

1. Introduction

North Norway is a large region covering 112.951 km^2, but it is sparsely populated with only approximately half a million inhabitants. Telemedicine and e-health are therefore especially important in North Norway. Telemedicine and e-health in the region can trace its roots back to 1988 when Telenor (a formerly state owned Norwegian telecom) launched the large-scale research project "Telemedicine in North Norway". Initially, Telenor targeted its telemedicine activities towards two principal areas. The first was modem-based transmissions of laboratory results to GP practices, and the second was remote consultations through videoconferences. Very soon several other pilot projects were spawned within medical fields, such as teleradiology, teledermatology, telepsychiatry, teledialysis, telepathology, tele-ENT, telecardiology, teleophthalmology, etc. A Telemedicine Department at the University Hospital of North Norway was established to promote, coordinate and implement the services, and many of these were subsequently put into routine use. The health authorities delegated the Department the role as National Centre of Competence for Telemedicine and it was renamed the Norwegian Centre for Telemedicine. In recent years, the Centre has been renamed the Norwegian Centre for E-health Research (NSE). As part of the early activities, plans for a Master programme in Telemedicine and E-health at the University of Tromsø arose.

The University of Tromsø (now named UiT Arctic University of Norway) is the world's northernmost university. It has more than 3600 employees and in excess of 16000 students. The university has a range of studies within all major fields of study, including life and health sciences, finance, languages, natural sciences, law, etc. According to the Times Higher Education World Ranking [1] the university's '…main

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teaching expertise lies in scientific fields such as polar environment, climate research, telemedicine, medical biology and fishery science'.

In 2005, the first students at the Master programme in Telemedicine and E-health were admitted. The programme was closed in 2018. In this paper, we will describe and discuss the background of the programme, its development and accomplishments and why it was closed. Hopefully, this discussion may help others who are planning or already running a Master programme in e-health.

2. Methods

Drawing on our experience as professors on the Programme and on evaluation reports [2], we briefly present and discuss the background, main contents, development, and closure of a Master Programme in Telemedicine and e-Health.

3. Results

The programme was a cooperation between the Faculty of Health Sciences and the Faculty of Science and Technology. It also involved collaboration with the University Hospital of North Norway and especially the NSE. The collaboration with NSE occurred over a broad area, including supervision of Master students, internships, lectures by NSE personnel on current projects and evaluations, research collaboration and PhD student positions.

There was also national and international collaboration in teaching, student exchange and research activities with other hospitals, universities and private companies. For instance, there was an international collaboration in terms of research and/or student activities with universities in Genova, Verona, Barcelona, Valencia, Graz, Krakow, San Diego, Copenhagen, Cambridge, Kathmandu, Tribhuvan and Khulna.

It was a two-year Master of Science programme with two fields of study, 'Technology', focusing on the technological construction of systems, and 'Health', focusing on the implementation and use of e-health and telemedicine in health services. In the following, we will focus on the 'Health' field of the programme unless otherwise stated.

The study was a 120 credits full-time programme. The first year of study consisted of 7 compulsory courses in different subjects: The topics of the courses were 1) Medical informatics, 2) Electronic patient records – theories, concepts and practice, 3) Telemedicine applications, 4) International health and environmental medicine, 5) Quantitative methodology, 6) Qualitative methodology, 7) Patients and the public as users of Net health services. The second year was fully devoted to the Master thesis.

The 'Health' field part of the programme was served by two full professors (the authors of this paper) with background in informatics and medicine, respectively, in addition to several part-time professors, post-docs, PhD students, and external collaborators from other academic and health institutions.

The students that participated in the Health-related Master had a wide variety of backgrounds, including nursing, medicine, pharmacy, physical therapy, dentistry, radiography, psychology, engineering, and public health. Among the 'Health' field students were also several leaders from hospitals and other parts of the Norwegian health services.

The students came from wide variety of countries, including the neighbouring areas of Denmark, Sweden, Iceland and Russia, Latvia, England, Germany, Czech Republic, Poland, Belgium, Austria, Slovakia, Greece, and the more distant countries such as Nepal, Bangladesh, the Philippines, India, Ghana, Nigeria, Eritrea, Ethiopia, Cameroon, and South Africa.

There was great variability in the topics and methodology of the Master theses. There were case studies, interview-based studies, surveys, epidemiological studies, in addition to different types of reviews. In addition, the programme shifted its focus and scope to encompass technological and societal developments and the "e-health" component in programme got an increasingly prominent role. Along with the widespread digitalization of the health care services, both the NSE and the Master programme got involved in evaluations of regional and national digitalization projects, for instance the implementation and use of Electronic Health Record systems, laboratory systems, nursing documentation, electronic medication managements systems and so on. And as the use of technology for health changed, the Master programme increased its emphasis on new forms of e-health, including social media and video services [3,4].

Up to and including 2016, 63 students had graduated (40 in the 'Health' field and 23 in the 'Technology' field), approximately ¼ were Norwegian and ¾ from other countries. Following graduation, most of the international students returned to their home countries, providing valuable knowledge that could be implemented in their local health services, private companies, and academic institutions. Many Master students have published work in international peer-reviewed journals during or after their studies [5-17].

The research group in Telemedicine and E-health that was associated with the Master programme was for a period of several years the Department of Clinical Medicine's most productive in terms of publications and completed PhDs. In the period 2007-2018, the group's members produced altogether 486 publications including 259 peer-reviewed scientific articles (of which 42 were so-called 'level 2', i.e. published in the presumed top scientific journals). Altogether 18 PhD candidates completed their studies as group members.

One major challenge for the programme was the recruitment of a sufficient number of students. The programme had 20 places for students each year, divided equally on the two fields of study. The total number of applicants to the programme in the years 2011-2016 was 716 (on average 119 students/year) of which 127 were students from the Nordic countries. While the number of applicants, and especially applicants from without the Nordic countries, was high, the number that actually started their studies was much lower. The 'Health' field recruited a mean of approximately 8 new students that started each year in the period 2011-2016 and the 'Technology' field a mean of less than 2 in the same period. In addition, some of the students that started their studies did not finish.

The university decided to close the programme in 2018, and the last students were supervised in 2020.

4. Discussion

The Master programme in Telemedicine and E-health was in a field with an increasing importance for the health services. The programme was a collaborative effort, representing different stakeholders and anchored in a strong and productive research

group. It was internationally acknowledged and recruited students from all over the world. Nevertheless, the programme was shut down in 2018.

One central explanation for the closure of the programme was the insufficient recruitment of students. While the biggest recruitment problems were in the 'Technology' field, there was also a recruitment challenge in the 'Health' field. One explanation for this difference in qualified students in the two directions of the program was that the health-related Master could recruit students with a wide range of health-related backgrounds, while those choosing the technology-related Master were fewer as it was required that they had qualifications in computer science. In the end, the programme was assessed on the basis of the total number of enrolled students – which was considered insufficient.

Another factor was the high representation of students from non-Nordic countries. While some considered the high degree of international participation a major strength of the programme, on the national level there was for some time a debate about whether students from outside the EU should have to pay for their studies [18]. However, today university courses in Norway still remain free for all. The programme had from its start some quota places for students from low income countries. The international students that were offered quota places were given extra benefits in terms of student scholarships and loans. The removal of the student quota places also negatively impacted the programme.

Perhaps the "telemedicine" notion itself was a cause to the closure of the programme. As a visionary concept, it promises to provide easy access to health services by disregarding geographical and bureaucratic boundaries. This concept may have been particularly attractive to international students from developing countries. However, at the same time, the "telemedicine" concept may also have been its downfall for two reasons: a) It lost its visionary attraction by successfully transforming into routine use, and b) Due to its relatively narrow scope it did not manage to reflect many of the ongoing challenges in the health care sector, for instance the challenges related to large-scale digitalization of different areas, platformization, shared electronic management system etc. Unfortunately, this perception overlooks the increasingly prominent role of the e-health component of "telemedicine and e-health". While the notion of telemedicine comes around as static, the notion of e-health (as a rather malleable concept) reflects and responds to current challenges in the health care sector.

The programme was repeatedly evaluated internally and in 2017 also externally. The external evaluation committee was positive to the continuation of the programme and had a range of suggestions regarding how to improve the quality of the study and its recruitment [2]. The students also evaluated the programme. While there naturally were different opinions, most students were satisfied with teaching, supervision and their work load. Some expressed a desire for better student facilities with better rooms for teaching and reading and improved digital equipment. Some expressed a wish for a broader selection of courses and more external collaboration, training in the health services and internships.

In the final years of the programme, several strategies to increase enrollment of Nordic students were implemented, including increased marketing also with student ambassadors [19], admitting students with a wider range of backgrounds and increasing net-based teaching, and having preparatory courses for Master theses to increase completion rates. In 2017, the 'Technology' field of the programme was closed. This co-occurred with the start up in 2018 of a new field of health technology studies at the Department of Informatics at the university. In 2018, a revision process was initiated

with an aim to update the study program, now increasing the focus on Nordic students. However, also this process was terminated in 2019.

5. Conclusions

The importance of e-health is increasing and there is a need for educational programmes focusing on e-health. In this paper we describe the Master Study in Telemedicine and e-Health at the University of Tromsø, Norway. We discuss the background of the programme, its development and significant accomplishments and why it nevertheless was closed. Future Master programmes in e-health may benefit from drawing on our experiences.

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